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Inventor(s): Nandakumar Sampath, Enrique Musoll, Stephen Melvin and Mario Nemirovsky

Title of Invention: Mechanism To Un-Speculatively Pre-Fetch Instructions From The Thread Associated To A Packet

Enclosed is a disclosure of the above-titled invention consisting of 5 sheets of description and 0 sheets of drawings. A check or money order in the amount of 10.00 is enclosed to cover the fee (37 CFR 1.21(c)).

The undersigned, being a named inventor of the disclosed invention, requests that the enclosed papers be accepted under the Disclosure Document Program, and that they be preserved for a period of two years.

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Signature of Inventor

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To fill out the form correctly, follow each set of instructions provided with each heading.

#### Title of Invention

This section is simply a brief descriptive title of the invention.

Insert title here: *Mechanism to un-speculatively pre-fetch instructions from the thread associated to a packet*

#### Inventors

We will need the residence address, mailing address, full legal names and citizenship of each inventor at the time of submission of the disclosure.

*Nandakumar Sampath*

*Enrique Musoll*

*Stephen Melvin*

*Mario Nemirovsky*

**Related inventions known or authored by you or your company**

This section should list any prior patents known to you or patents that you have already filed if the present invention depends on them for successful practice.

[1] PA3818

**Background**

This section is used to describe “the state of the art” before being improved or enhanced with your invention. It should include a brief summarization of existing technologies if any that the present invention improves upon or replaces, a description of any specific problems with “the way the art is practiced now”, and a very brief statement of what is needed to improve or replace the existing art. Include references by U.S. patent number any closely related patents discovered during any prior-art searches

Begin Background here:

*The PMU unit within XCaliber receives the newly arrived packets and activates an available (i.e. not used by the SPU) context after pre-loading some of the registers of the context with useful information about the packet.*

*Upon the activation of the context, the SPU can start fetching and executing the instructions of the corresponding thread.*

*An improvement in performance is achieved if the SPU is notified as soon as the PMU selects a context for activation and before the pre-loading of the registers starts.*

*Therefore, the SPU can pre-fetch the instructions of the corresponding thread. These instructions will not start to be executed until the context is activated by the PMU.*

*This mechanism of notification to the SPU that a pre-load of a packet starts has been briefly mentioned in the description of patent disclosure [1], but not covered with any claim.*

### **Description of Invention**

This section should explain the basic apparatus and method of practicing your invention according to a preferred state. If certain **apparatus** of the invention is not known in the prior art then indicate so. If a **method** of the present invention is not known in prior art then indicate so. If certain methods and apparatus are known in prior art then they do not have to be greatly detailed. However any new subject matter novel over the prior art should be fully explained and represented by drawings and/or sketches.

Begin description here:

*One function of the PMU unit within XCaliber is to activate an available (i.e. not used by the SPU) context after pre-loading some of the registers of the context with useful information about the packet to be processed.*

*The unit within the PMU that performs this task is called Register Transfer Unit or RTU, and it performs the activation in three different steps:*

- 1. Notifies the SPU that a context has been selected for activation, and that the pre-loading of that context is going to start.*
- 2. Stores in some of the registers of the selected context information regarding the packet (an identifier of the packet, the address where the packet resides in the packet memory and, possibly, some bytes of the header and/or the payload).*
- 3. Notifies the SPU that the context is ready for processing, i.e. the context is activated*

*In both steps 1 and 2 the RTU provides to the SPU the number of the context selected and the PC address where the stream that will run on the context will start fetching instructions from. This PC address is programmable in the RTU, and it can be different depending on the queue within the queuing system block of the PMU the packet is activated from. This is how it has been implemented in XCaliber. Another option would be that the PMU does not provide any PC address and the SPU always starts fetching from a fixed PC address regardless the queue number.*

*Step 2 may take several cycles, especially if bytes of the header and/or payload of the packet are pre-loaded in some of the registers of the context.*

*Step 1 is not required for the correct behavior of packet activation, however it provides a performance improvement since the SPU can use its idle resources to start fetching the instructions that will eventually be executed. Note that these instructions are un-speculatively fetched since when the RTU starts the activation of a context, it will eventually finish it, meaning that a new stream will be created in the SPU.*

*Thus, as soon as step 3 occurs, the SPU might have already fetched the instructions and is ready to execute them with no delay. In a design without step 1, the SPU would need to wait to start executing instructions until the instructions have been fetched (which might take a long time if the instructions do not reside in the instruction cache).*

*What is disclosed here is step 1, which is non-obvious and it provides improved performance on the SPU by hiding the latency of fetching the initial instructions for an stream.*

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